A photograph of a green and black stethoscope lying diagonally across a large, vibrant green cannabis leaf. The background is a solid teal color.

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Is There A Correlation?

Opioids & Marijuana

The Hypothesis

States that have legalized marijuana (both for medical and recreational) see an increase in the number of opioid related deaths.



Why?

With an increase in opioid abuse and a string of states legalizing the use of marijuana for both recreational and medical use, we wanted to investigate the impact of marijuana on opioid deaths. As a group we determined we'd try solving for the hypothesis above.

Data & Methods

- The opioid data that was collected came from the **Center For Disease Control (CDC)**.
- We were able to create a **table for marijuana legalization** and used that to supplement the opioid data.
- To clean the data, we got rid of irrelevant data columns and kept the death rate, the year, the state, the type of opioids, and information on whether recreational or medical was legal or not. Dropped blank data **DROPNA**
- We combined the data into one table and gleaned our information from that table.

Year	Kentucky	Nevada	New Hampshire	New Mexico	Ohio	Oklahoma	Oregon	Utah	Washington	West Virginia
0	2017	86.8	73.0	52.8	56.4	63.5	88.1	66.1	63.8	57.2
1	2016	97.2	80.7	64.3	65.1	75.3	97.9	76.3	70.4	64.9
2	2015	102.6	85.4	74.8	69.8	82.7	104.4	84.2	74.4	69.8
3	2014	110.0	90.1	79.6	71.5	89.5	110.9	91.9	78.8	74.2
4	2013	111.7	91.1	82.0	71.4	93.1	123.3	94.2	82.1	75.2
5	2012	127.9	98.9	83.7	76.8	97.5	127.4	98.7	84.5	78.7
6	2011	137.0	100.3	80.9	81.6	101.5	122.3	100.7	85.2	81.6
7	2010	136.5	97.3	81.6	81.9	102.4	119.6	101.2	86.6	85.0
8	2009	135.2	94.0	81.5	75.3	100.4	115.0	99.3	86.9	86.1
9	2008	136.6	97.0	81.7	71.4	97.5	111.3	99.1	91.3	86.6
10	2007	130.8	90.2	78.5	69.0	92.7	114.4	95.5	89.8	84.4
11	2006	122.6	87.7	75.0	61.8	87.7	108.7	91.0	87.0	80.8

	State	Year	Death_Rate	Deaths	Multiple_Cause_of_death	Medical	Recreational	percent_change	Rx_rate
0	Wyoming	2006	0.0	0.0	All Opioids	False	False	NaN	79.9
1	Wyoming	2007	0.0	0.0	All Opioids	False	False	NaN	80.8
2	Wyoming	2008	5.8	35.0	All Opioids	False	False	NaN	81.0
3	Wyoming	2009	0.0	27.0	All Opioids	False	False	-0.228571	81.0
4	Wyoming	2010	7.7	33.0	All Opioids	False	False	0.222222	80.4

Datasets Merged

- **CDC Opioid Death Rate Dataset by state, by year**
- **Marijuana Legalization by year, by state**
- **CDC Opioid Prescriptions**

<https://www.cdc.gov/drugoverdose/data/prescribing.html>

Data & Methods

states	current st	medical	Yr Recreatio	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Alabama	Illegal			FALSE																					
Alaska	Recreatio	1998	2014	TRUE																					
Arizona	Medical	2010		FALSE	TRUE																				
Arkansas	Medical	2016		FALSE	TRUE	TRUE	TRUE	TRUE																	
California	Recreatio	1996	2016	TRUE																					
Colorado	Recreatio	2000	2012	FALSE	FALSE	TRUE																			
Connectic	Medical	2012		FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE															
Delaware	Medical	2011		FALSE	TRUE																				
Florida	Medical	2016		FALSE	TRUE	TRUE	TRUE	TRUE	TRUE																
Georgia	Illegal			FALSE																					
Hawaii	Medical	2000		FALSE	FALSE	TRUE																			
Idaho	Illegal			FALSE																					
Illinois	Recreatio	2013	2019	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE															
Indiana	Illegal			FALSE																					
Iowa	Medical			FALSE																					
Kansas	Illegal			FALSE																					
Kentucky	Illegal			FALSE																					
Louisiana	Medical	2015		FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE															
Maine	Recreatio	1999	2016	FALSE	TRUE																				
Maryland	Medical	2014		FALSE	TRUE																				
Massachu	Recreatio	2016	2016	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE															
Michigan	Recreatio	2008	2018	FALSE	TRUE																				
Minnesota	Medical			FALSE																					
Mississippi	Illegal			FALSE																					
Missouri	Medical	2018		FALSE	TRUE	TRUE	TRUE																		
Montana	Medical	2004		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE															
Nebraska	Illegal			FALSE																					
Nevada	Recreatio	2000	2016	FALSE	FALSE	TRUE																			
New Ham	Medical	2013		FALSE	TRUE																				
New Jers	Medical	2010		FALSE	TRUE																				
New Mex	Medical	2007		FALSE	TRUE																				
New York	Medical	2014		FALSE	TRUE																				
North Car	Illegal			FALSE																					
North Dak	Medical	2016		FALSE	TRUE																				
Ohio	Medical			FALSE																					
Oklahoma	Medical	2018		FALSE	TRUE	TRUE																			
Oregon	Recreatio	1998	2014	TRUE																					

Datasets Merged

- CDC Opioid Death Rate Dataset by state, by year
- Marijuana Legalization by year, by state
- CDC Opioid Prescriptions

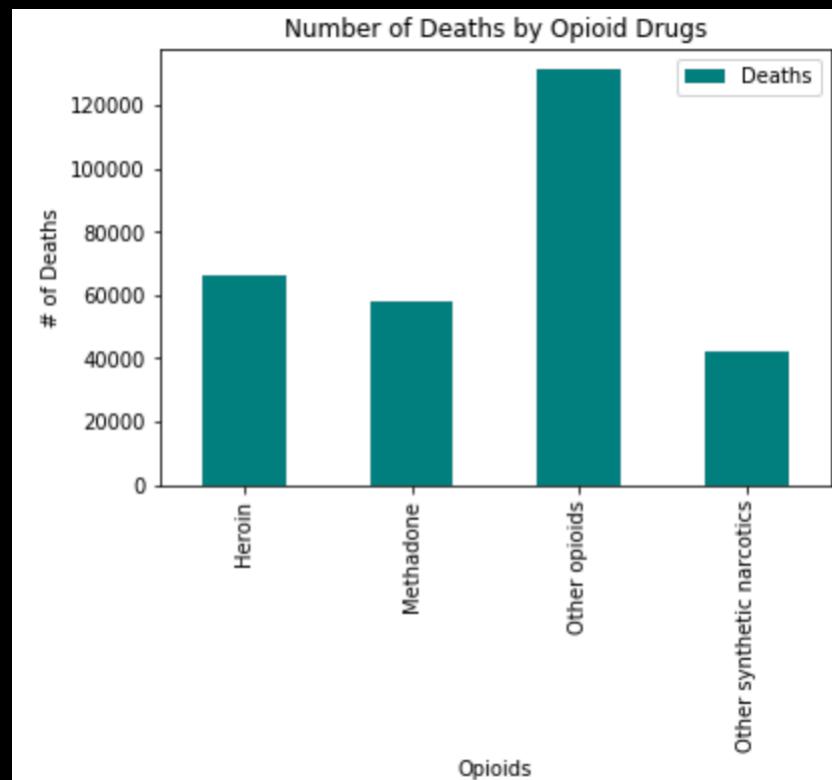
<https://www.cdc.gov/drugoverdose/data/prescribing.html>

Opioids

An illustration depicting the opioid crisis. On the left, several people are shown as small figures inside translucent capsules, some appearing distressed or unconscious. A large, brown prescription bottle with a white label featuring a stylized 'RX' is positioned behind them. The background is a light blue with abstract yellow and orange shapes.

Deadly
Opioids

Question 1: Which drugs are considered opioids and which have the highest mortality rate?

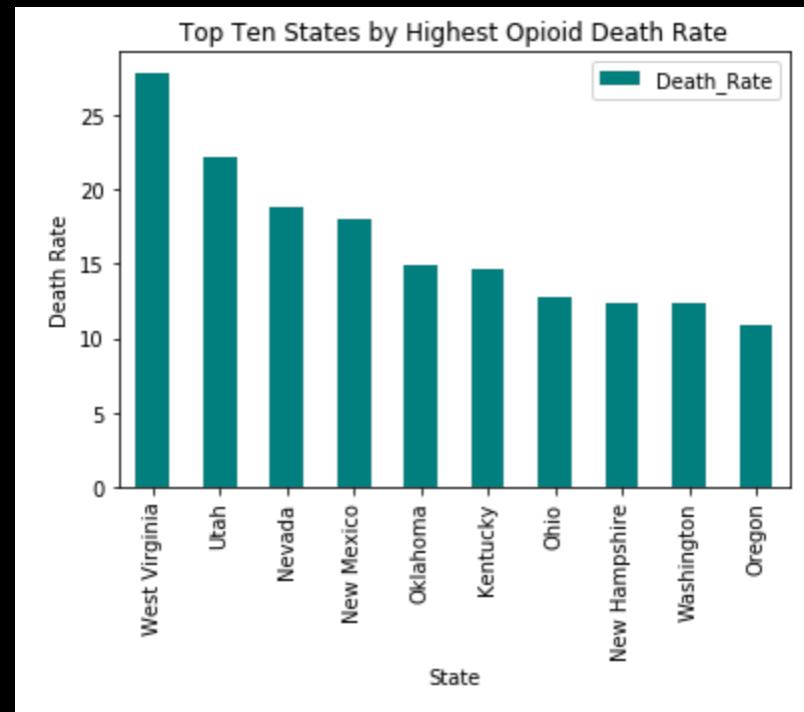


- **Other opioids** (including morphine and codeine) and **semi-synthetic opioids** (drugs like oxycodone, hydrocodone, hydromorphone, and oxymorphone)
- **Methadone**, a synthetic opioid
- **Other synthetic narcotic opioids** other than methadone (drugs like tramadol and fentanyl)
- **Heroin**, an illicit (illegally made) opioid synthesized from morphine that can be a white or brown powder, or a black sticky substance.

*2000-2016

Prescribed ‘Other Opioids’ have the highest mortality rate
Morphine, codeine, oxycodone, hydrocodone, hydromorphone, and oxymorphone.

Question 2: Which states have the highest opioid deaths?



*2000-2016

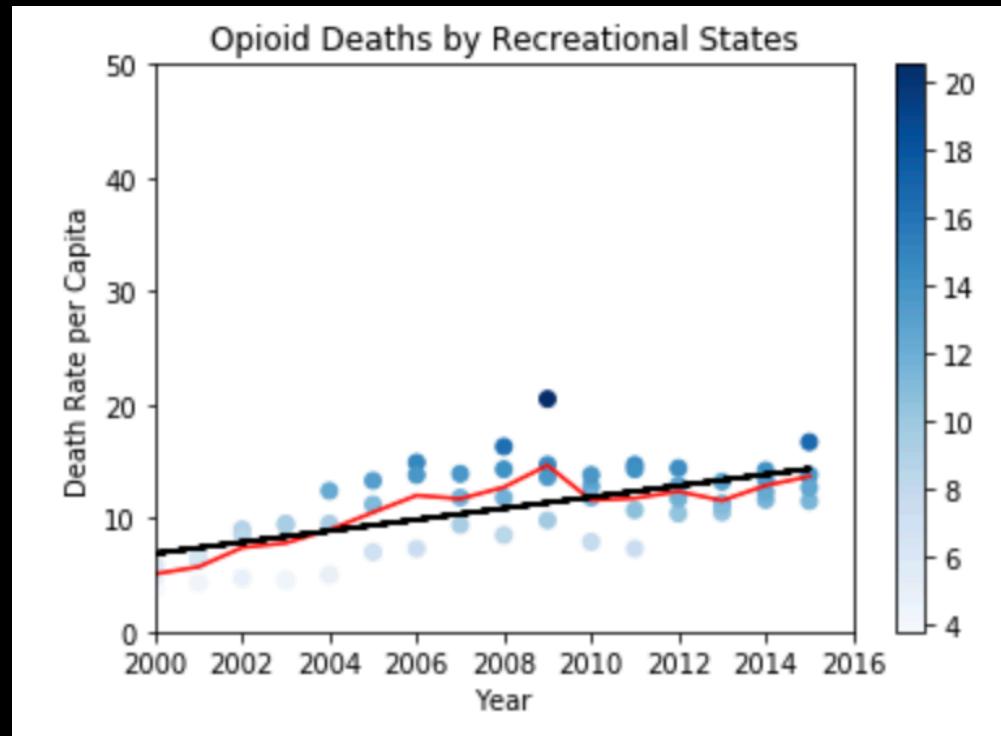
West Virginia, Utah, Nevada, New Mexico, Oklahoma, Kentucky, Ohio, New Hampshire, Washington, and Oregon.



Legalizing Marijuana



Question 3: Is there a difference in states that have legalized recreational marijuana?

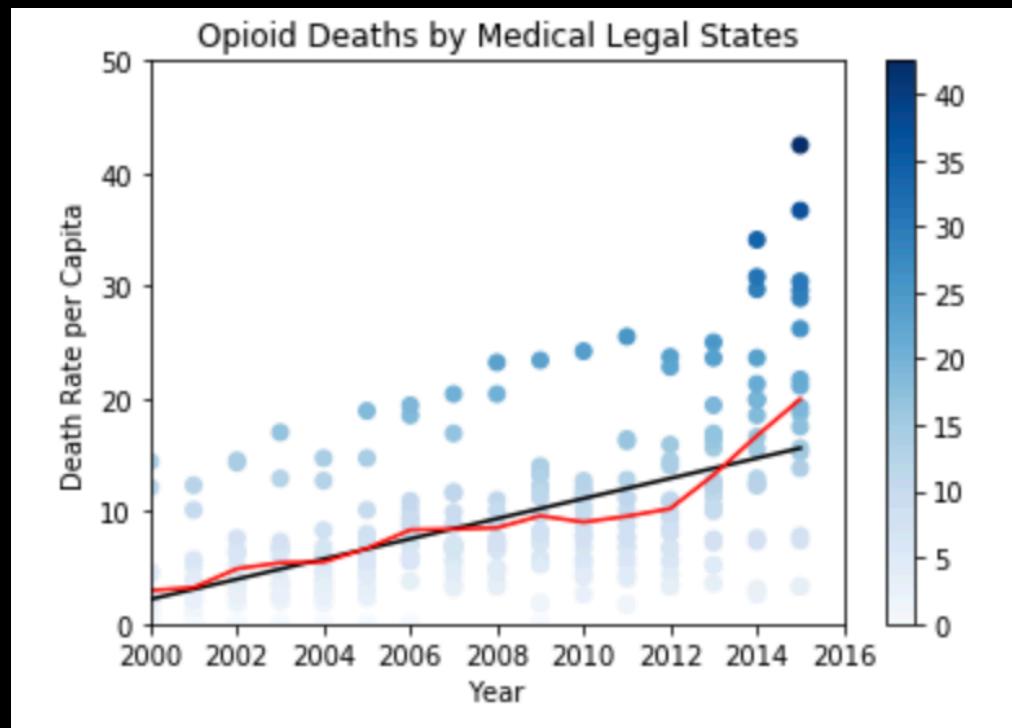


r value: 0.64424770958377

* Recreational States: {'Alaska', 'Washington', 'Colorado', 'Oregon'}

It does not look like there is any statistically significant difference between the states when it comes to legal status of marijuana and death rate. All states have seen a steady incline in opioid deaths.

Question 4: Is there a difference in states that have legalized medical marijuana?

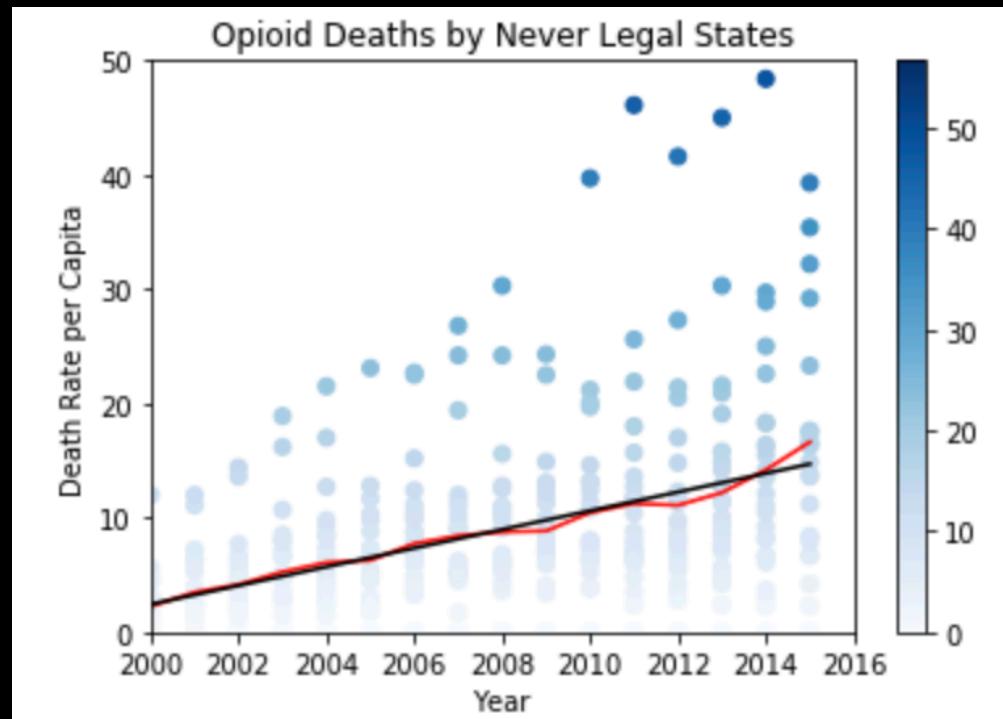


r value: 0.5804566281126241

Medical States: {'Montana', 'New York', 'Nevada', 'New Mexico', 'Louisiana', 'Vermont', 'Rhode Island', 'New Jersey', 'New Hampshire', 'Maine', 'Maryland', 'Hawaii', 'Connecticut', 'Arizona', 'Michigan', 'Illinois', 'California', and 'Delaware'}

It does not look like there is any statistically significant difference between the states when it comes to legal status of marijuana and death rate. All states have seen a steady incline in opioid deaths.

Question 5: Is there a difference in states that have not legalized marijuana?



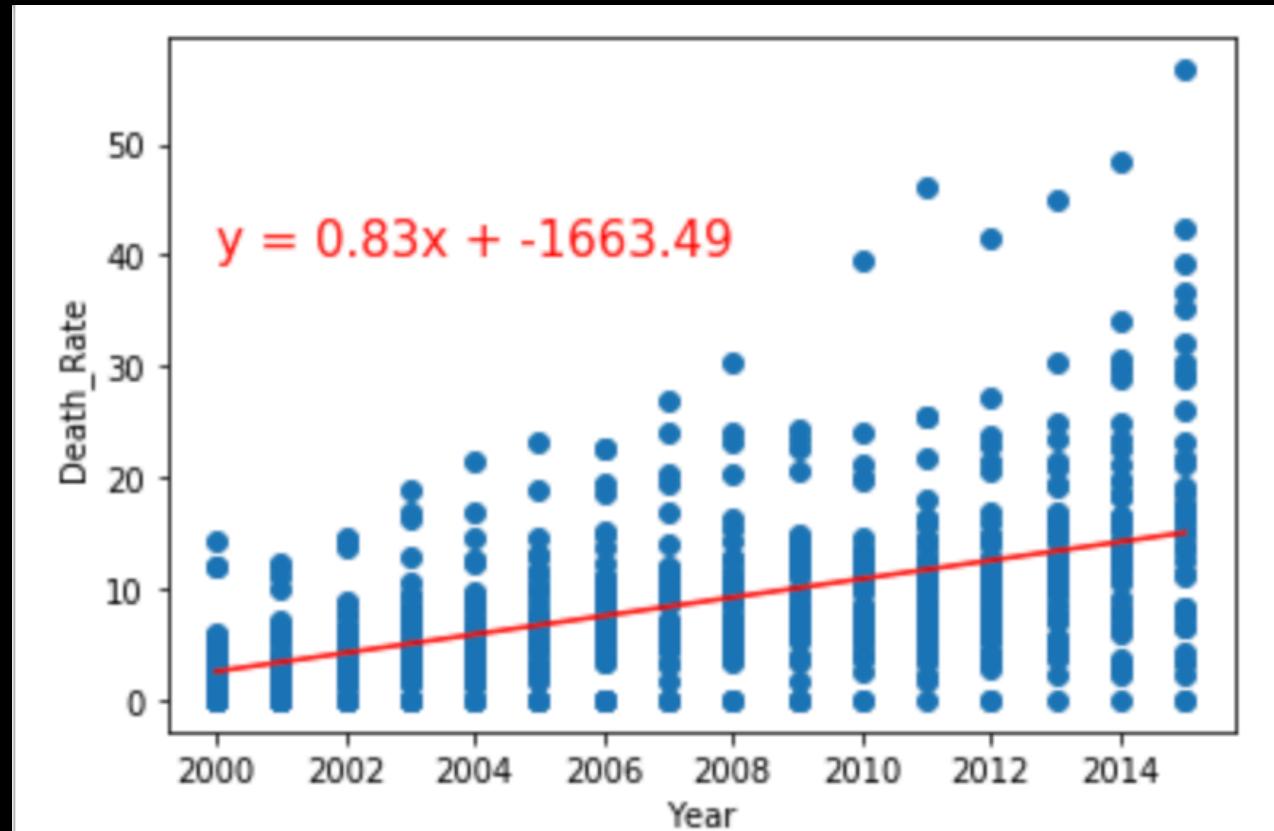
r value: 0.45590251351203165

*

Never Legal States: {'Texas', 'Massachusetts', 'South Carolina', 'Ohio', 'Virginia', 'Kansas', 'Idaho', 'Utah', 'Nebraska', 'Wisconsin', 'West Virginia', 'Georgia', 'Iowa', 'Wyoming', 'North Carolina', 'Tennessee', 'South Dakota', 'Alabama', 'Oklahoma', 'Indiana', 'Pennsylvania', 'Florida', 'North Dakota', 'Kentucky', 'Missouri'}

It does not look like there is any statistically significant difference between the states when it comes to legal status of marijuana and death rate. All states have seen a steady incline in opioid deaths.

Review of All States and All Opioid Death Rates



r value: 0.5051424621181142

Opioid related deaths continue to increase year over year.



Opioid Prescriptions

Opioid Prescriptions by Recreational States

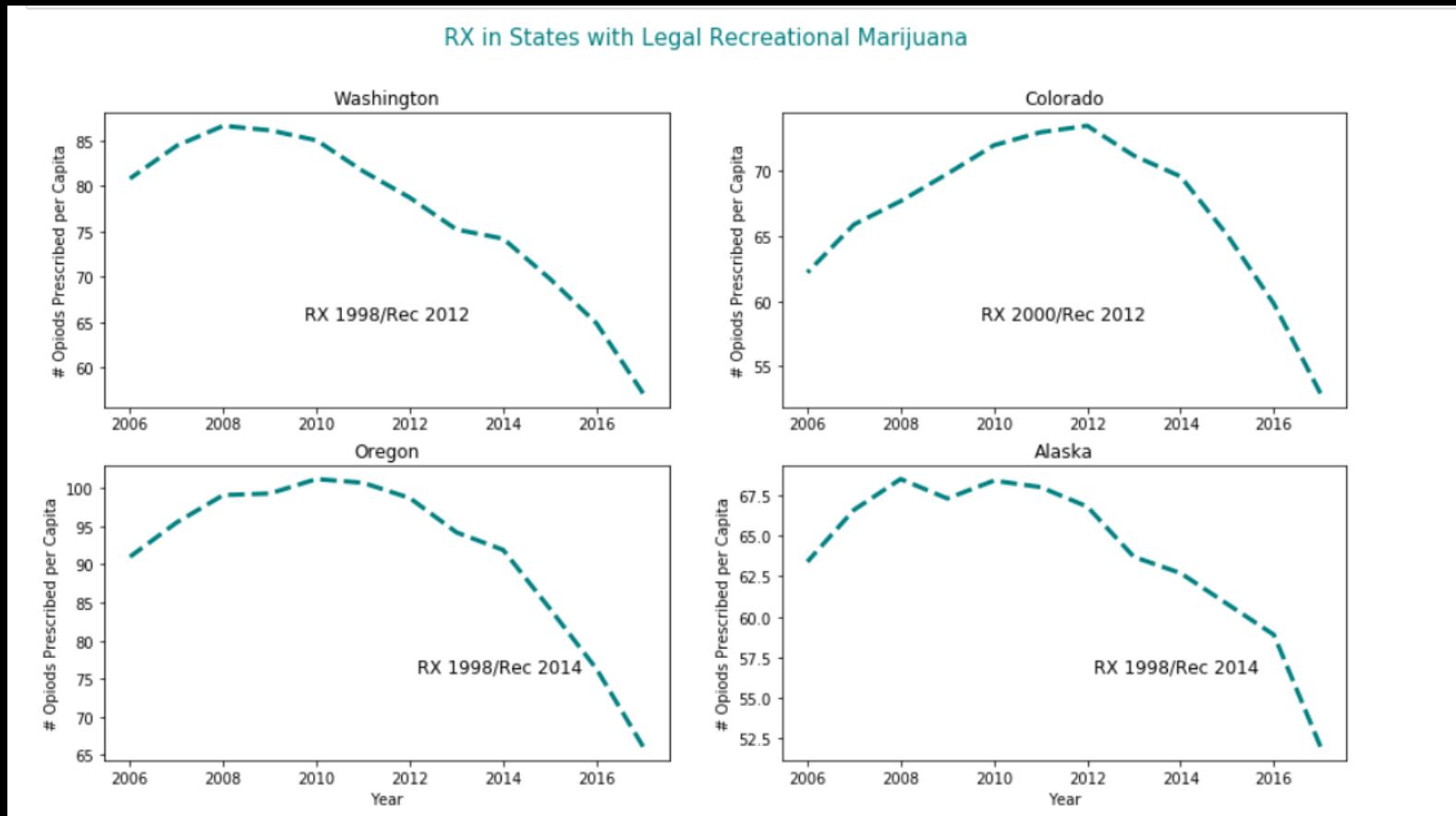
Alaska legalized recreational marijuana in 2014. This didn't seem to affect the general trend downward.

Oregon has also seen a steady decline over time. Recreational marijuana was also legalized in 2014.

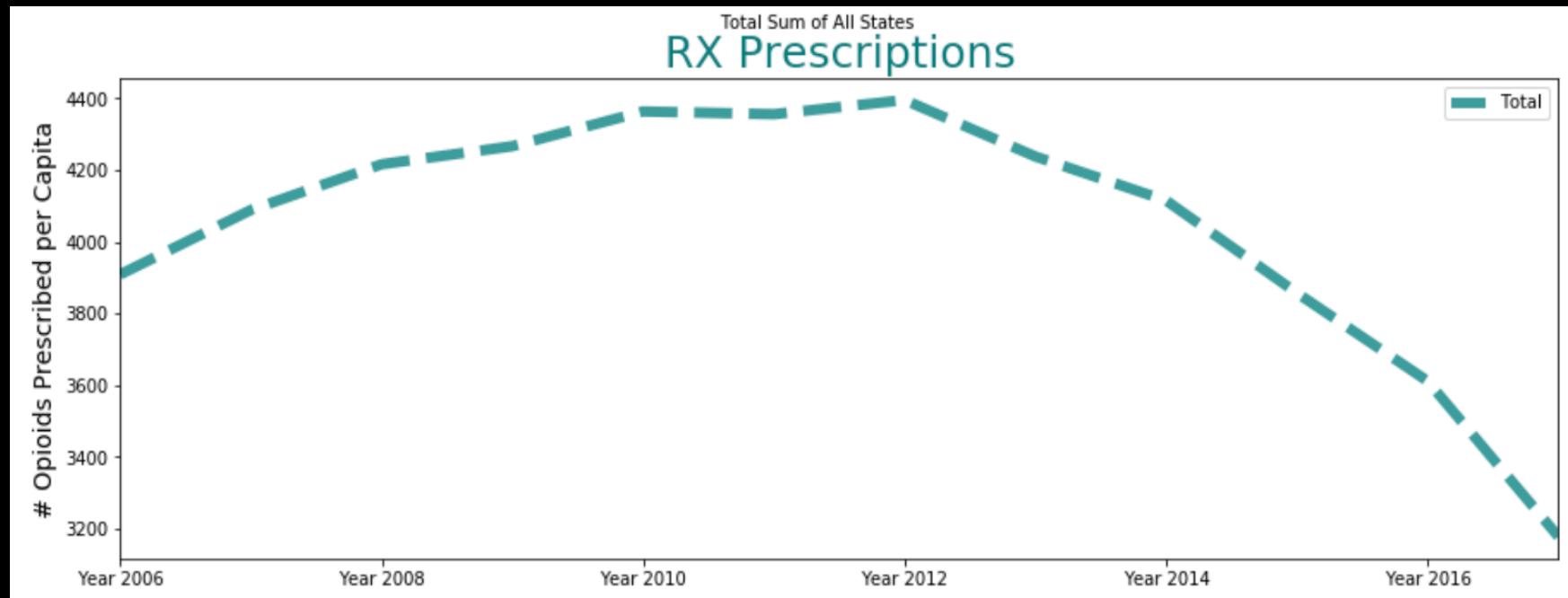
After 2012, Colorado sees an immediate decline in prescriptions. It may be worth noting that Colorado legalized recreational marijuana in 2012.

Washington has seen a steady decline throughout, even When it was legalized recreationally in 2012.

New programs became available in 2012 to track prescription drugs. Prescription drug monitoring programs (PDMPs)



Opioid Prescriptions are on the decline

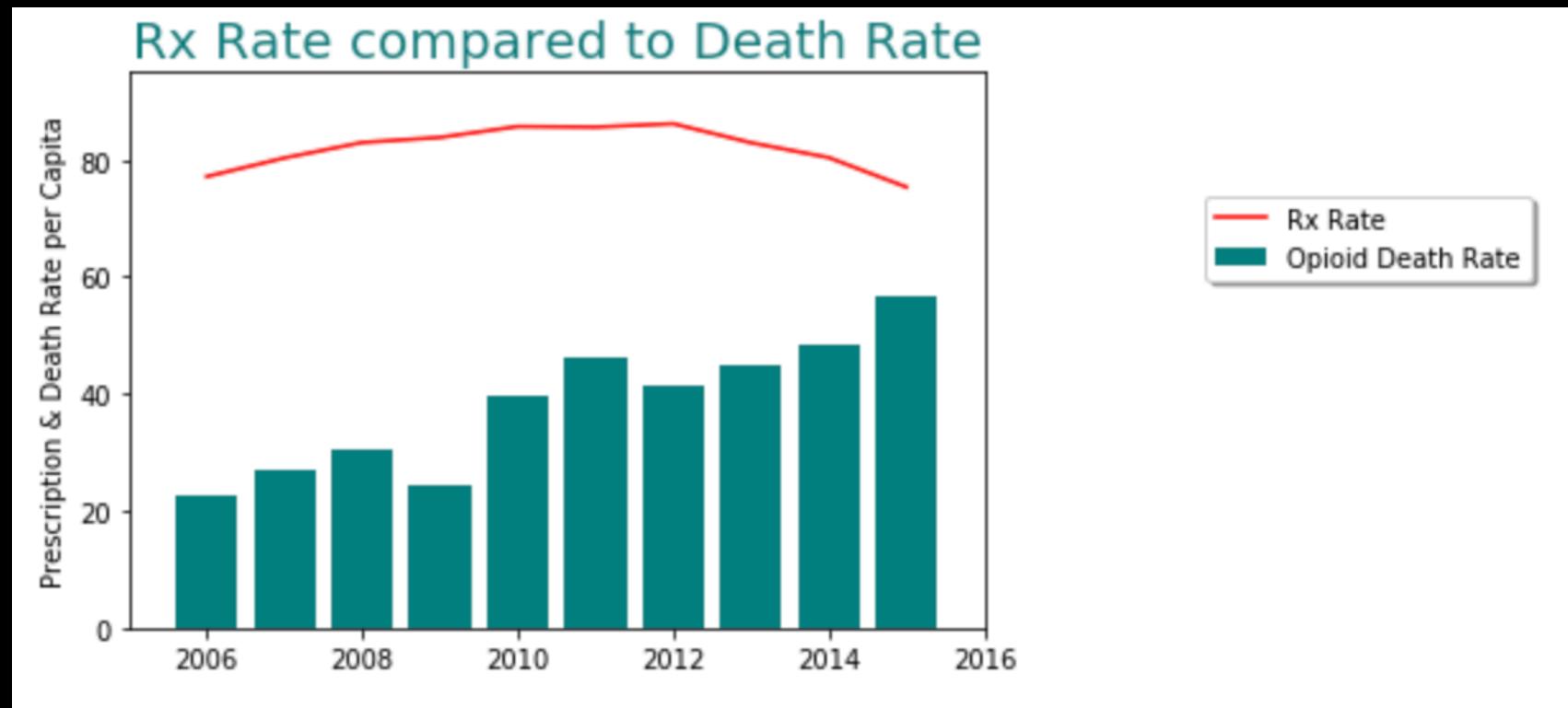


- Colorado and Washington State legalized recreational marijuana in 2012. Oregon and Alaska legalized recreational marijuana in 2014
- New programs became available in 2012 to track prescription drugs.
- Prescription drug monitoring programs (PDMPs) – State or territorial-run electronic databases that track controlled substance prescriptions. PDMPs help providers identify patients at risk of opioid misuse, opioid use disorder, and/or overdose due to overlapping prescriptions, high dosages, or co-prescribing of opioids with benzodiazepines



*2012

Even As Opioids Prescriptions Fell Death Rates Went up



Beginning in 2012, as states passed legislation limiting prescriptions in the market and legalized marijuana recreationally, the national opioid death rate continued to creep upward. Even with a decrease in prescriptions there was no meaningful change in the death rate.

Conclusion



**According to our data,
there is no strong correlation to opioid related deaths and
medical and recreational marijuana becoming legal.**

Variables, such as new prescription drug legislature, government regulations, and drug prevention programs i.e. (PDMP) have contributed to decreases in prescription drugs entering the market. Even with the decrease in legally prescribed drugs we continue to see an increasing trend in opioid related deaths.

We accept the null hypothesis that there is no correlation of opioid related deaths in relation to legalizing medical and recreational marijuana.

QUESTIONS

